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Revision of *Acanthopsoides* Fowler, 1934 (Cypriniformes: Cobitidae), with the Description of New Species

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Abstract The genus *Acanthopsoides* Fowler, 1934 is revised; *Neacanthopsis* Smith, 1945 is placed in the synonymy of *Acanthopsoides*. In addition to *Acanthopsoides gracilis* Fowler, 1934 and *Acanthopsoides gracilentus* (Smith, 1945), four new species are described in the genus. These are *A. delphax* of the Salween, Chao Phraya and Mekong river basins, *A. hapalias* of the Mekong River basin, *A. molobrion* from peninsular Thailand, Malaysia and Borneo, and *A. robertsi* from the Kapuas River basin and adjacent areas, Borneo. The known distribution of the genus includes most of Southeast Asia. *Acanthopsoides gracilis*, *A. gracilentus*, and *A. delphax* are sympatric: *A. molobrion* and *A. robertsi* in the Kapuas River basin and *A. gracilentus*, *A. delphax* and *A. hapalias* in the Mekong River basin may be also. The increase in the diversity of *Acanthopsoides* recognized herein may be indicative of the level of the unknown diversity of the Southeast Asian freshwater fish fauna in general.

Fowler (1934) described a new genus for a new species of small loach from northwest Thailand which was similar in appearance to species of *Acantopsis* van Hasselt (see Alfred, 1961; Roberts, 1989; and Burridge et al., 1990 for a discussion of the spelling *Acantopsis* vs. *Acanthopsis*). He named the new genus *Acanthopsoides* because of this similarity, and the new species *A. gracilis* because of its slender form. Smith (1945) later described a new genus and species for another small loach from northwest Thailand which was also similar in appearance to species of *Acantopsis*. Smith named his new genus *Neacanthopsis*, and the new species *N. gracilentus*, for reasons similar to those stated by Fowler (1934) when Fowler coined the names for the taxa he described earlier. A year later Fraser-Brunner (1946) synonymized *N. gracilentus* with *Cobitis taenia* L., apparently acting solely from Smith's description and without specimens of the species in hand. Except for a single specimen, all of Fowler's nearly seventy specimens of *A. gracilis* were from the Meping (=Mae Nam Ping) of the Chao Phraya River basin, as were all four specimens of Smith's *N. gracilentus*. Museum holdings of small loaches which are similar in appearance to species of *Acantopsis* from throughout most of mainland Southeast Asia have slowly increased. Holdings of small loaches from Borneo, similar in appearance to the ones from the mainland, have been accumulating too, sometimes misidentified as species of *Acantopsis*. A review of these additional materials lead to the realization that these small *Acantopsis*-like loaches, and *Neacanthopsis gracilentus*, were *Acanthopsoides* species.

Fowler and Smith each referred to the name *Acantopsis choirorhynchos* Bleeker when they coined the names *Acanthopsoides* and *Neacanthopsis*. *Acantopsis choirorhynchos* Bleeker is not the valid name for the species Fowler and Smith compared their new taxa with (work in progress). But in the spirit of Fowler's and Smith's comparisons with the species they knew as *Acantopsis choirorhynchos*, and in recognition of Bleeker's contribution to ichthyology in Southeast Asia, 3 of the new species of *Acanthopsoides* described in this paper will be named in the theme of Bleeker's epithet *choirorhynchos*. The name *choirorhynchos* means hog-nose, and is a very appropriate name for the species so named by Bleeker. In conjunction with the intent of Bleeker's epithet and the fact that *Acanthopsoides* species, so far as is known, are much smaller than *Acantopsis* species, these 3 new *Acanthopsoides* species will be named piglet, young pig, etc. The fourth species will be named for one of the collectors of the material.

Materials and methods

Measurements of the head of *Acanthopsoides* species were made with an ocular micrometer mounted on a Wild M-7 Stereomicroscope and were

recorded to the nearest tenth of a millimeter. Standard length (SL), head length (HL), predorsal length (PDL), and pre-pelvic length (PPL) were taken with dividers which were then laid on a steel rule, or with needle-pointed dial calipers. These measurements, snout length (SNT) and eye length (EYE) were estimated to a tenth of millimeter, and were taken as set out in Hubbs and Lagler (1947). Snout to occiput length (SNT-OCC) was measured from the tip of the snout to the nape and post-ocular length (POL) was measured from the posterior edge of the eye to the point of anterior encroachment on the skull of the epaxial musculature. Proportions of parts of the head, except for HL, are reported as per cent HL. Head, pre-dorsal, and pre-pelvic lengths are reported as per cent SL.

Dorsal-fin ray, pleural rib, and vertebral counts were taken from radiographs. The vertebral counts reported include only post-weberian vertebrae with the fused element consisting of PU1 and U1 counted as one element. Some vertebral counts for cobitine loaches recorded in the literature report total vertebral number. Adding the four vertebrae incorporated into the Weberian apparatus to the post-weberian vertebral counts reported herein gives total vertebrae. Peduncular vertebrae number was counted as the number of vertebrae completely posterior to the last anal fin pterygiophore, that is, vertebrae were counted as peduncular vertebrae if they fell behind a vertical line marking the posterior edge of the last anal pterygiophore.

The relative positions of the dorsal, pelvic, and anal fins was measured by noting the positions of the fins along the vertebral column, that is, in terms of vertebral segments. The position of the dorsal fin along the vertebral column was recorded as the number of the post-weberian vertebrae at which the blade (the proximal radial) of the first dorsal pterygiophore is inserted in front of the neural spine. The position of the pelvic fin was taken as the number of the post-weberian vertebrae at which a vertical line from the posterior edge of the pelvic girdle intersected with the vertebral column. Anal fin position was recorded as the post-weberian vertebrae number at which the blade (the proximal radial) of the first anal pterygiophore is inserted in front of a haemal spine.

Materials are organized by major river basin in lists of materials examined. The number of specimens in each lot is reported, in parentheses, immediately following the catalog or register number of the lot. Names of streams and places are reported as recorded on jar labels or as reported in original literature. Modern equivalents of these names, from Official Standard Names series of gazetteers, United States Department of Interior, are given parenthetically following the older spellings. River basin information has been added parenthetically where it was not originally included on jar labels.

Institutional abbreviations are as listed in Leviton, et al. (1985), except for ZSM. ZSM is for Zoologische Staatssammlung, Munchen.

Genus *Acanthopsoides* Fowler, 1934

Acanthopsoides Fowler, 1934: 103 (type-species: *Acanthopsoides gracilis* Fowler, 1934, by original designation).
Neacanthopsis Smith, 1945: 297 (type-species: *Neacanthopsis gracilentus* Smith. 1945, by original designation).

Diagnosis. Small cobitids of the subfamily Cobitinae with body terete; peduncle slender; head scaleless, head length approximately 20% of SL; eye small, 5.2 to 7.2 in head, placed high on head; snout length moderate, 2 to 2.5 in head (usually greater than 2.2 in head, eye usually in anterior half of head); suborbital spine bifid, reaches posteriorly to beneath at least anterior margin of eye; infraorbital lateral line canal present; lateral line usually incomplete (very rarely complete in *A. delphax*); males with first branched pectoral-fin ray thickened and elongated (Fig. 1); dorsal fin with 7 branched finrays (exceptional individuals with 8), dorsal origin slightly postmedian along SL, inserted slightly before to over pelvic fin origin; caudal fin symmetrical, emarginate.

Remarks. *Acanthopsoides* is easily distinguished from other cobitine genera of Southeast Asia by the above combination of features. Species of the genera *Lepidocephalus* Bleeker, *Lepidocephalichthys* Bleeker, *Eucirrhichthys* Perugia, and *Neoeucirrichthys* Banarescu and Nalbant all have scales on the head, *Acanthophthalmus* Bleeker (including *Cobitophis* Myers) species are all much more elongate (as *Eucirrhichthys* is also), and *Acantopsis* van Hasselt and *Somileptes* Swainson species all have 8 or more branched dorsal-fin rays.

Smith (1945) reported 8 dorsal-fin rays as characteristic of the genus *Neacanthopsis*. However, examination of his materials, and of additional specimens, reveals the number of branched dorsal-fin rays to be 7. The last branched fin ray may be split to its base but is supported by a single pterygiophore.

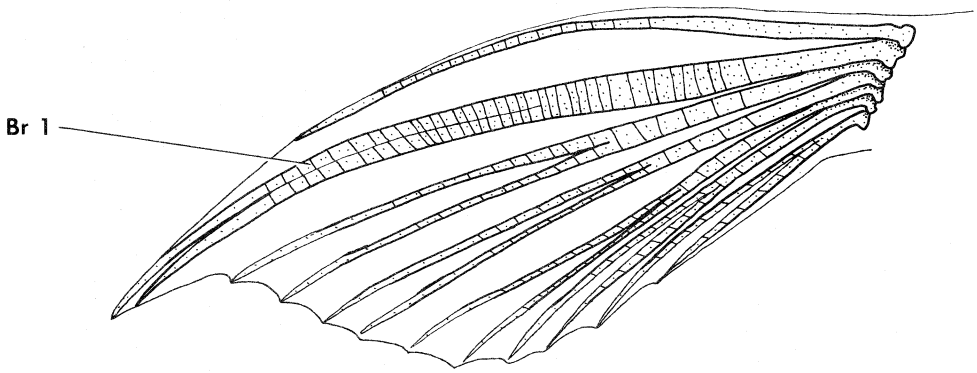

Fig. 1. *Acanthopsoides gracilentus*, USNM 229332. Ventral view of the pectoral fin of a mature male. Br1 = first branched pectoral-fin ray.

Acanthopsoides species share a basic color pattern. Certain aspects of this pattern do, however, vary among the individual species. The basic pattern consists of three lines or fields of dark brown epidermal blotches on the head and body, and is comparable to elements of a more complex pattern illustrated for some *Cobitis* species by Saitoh and Aizawa (1987). In particular, species of *Acanthopsoides*, and of some other cobitine genera also, have a mid-dorsal and a mid-lateral row of markings that are similar to rows of markings on *Cobitis* species (rows designated as L1 and L5 by Saitoh and Aizawa, 1987). Other authors (Fowler, 1934; Smith, 1945) have not associated the pattern of blotches of the head with that of the body, instead describing the blotch pattern of the head separately from that of the body. "Head" and "trunk" patterns are in actuality continuous, and division of the color pattern of cobitine loaches into head and trunk regions is artificial.

The mid-dorsal row consists of a row of blotches extending from the tip of the snout to the base of the caudal fin. The blotches may be round, but most often are squarish or rectangular in shape. Mid-dorsal blotches are more crowded on the head than on the body, and are, generally, regularly spaced behind the occiput. The number, and size, of blotches varies among species.

The mid-lateral row of markings also extends from the snout to the caudal fin. These lateral blotches vary in shape from round to elliptical (vertically elongate), and their size varies from smaller than the pupil of the eye to eye size. On the head the row consists of a series of spots on the cheek that curves beneath the eye; on the trunk the row is positioned along the myoseptum, or just ventral to it. The blotches along the trunk typically are larger than those on the cheek. Deep to this row of blotches along the trunk is a stripe consisting of a field of densely spaced chromatophores. In some specimens, this deeper stripe is intensified so as to obscure the individual blotches of the superficial row of spots. Blotch number varies within and among species.

Between the mid-dorsal and mid-lateral rows of blotches is a chaotic field of irregularly sized, shaped, and placed blotches that, like the mid-dorsal and mid-lateral rows, varies from species to species. No specific correspondence of this field on *Acanthopsoides* to elements of the pattern described for *Cobitis* species is obvious.

In addition to the blotches described above, *Acanthopsoides* species also exhibit a dark stripe from the eye to the tip of the snout, bands on the caudal and dorsal fins, and spots at the caudal base. The stripe on the side of the snout is often intense. It runs below the nares and is associated with the infraorbital laterosensory canal and the slit for the suborbital spine. This stripe has a wide distribution among cobitine loaches.

Bands of dark pigmentation occur on the median and paired fins of species of *Acanthopsoides*, though pigmentation of the pelvic and pectoral fins appears to be restricted only to strongly marked individuals. Pigmentation of fins consists of chromatophores on the fin rays themselves. The interradial membranes are clear. Fowler (1934) and Smith (1945) did not mention pigmentation of the dorsal fin, but bands of chromatophores do occur on the dorsal fin of *Acanthopsoides* species. The number and shape of bands of chromatophores that mark the caudal fin of spe-

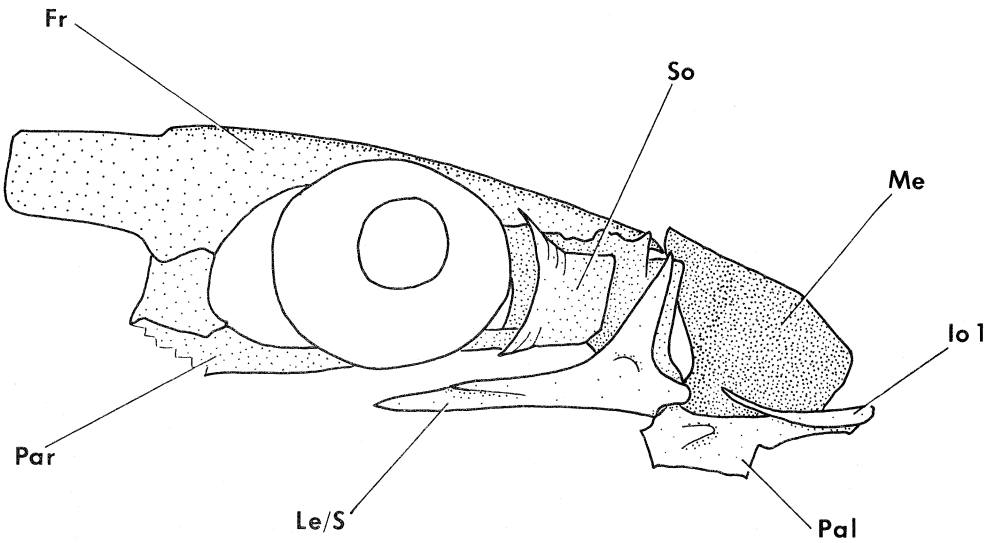

Fig. 2. *Acanthopsoides gracilentus*, USNM 229332. Certain osteological elements of the anterior portion of the head; right side view, anterior to the right. Fr=frontal; Io1=first infraorbital; Le/S=suborbital spine (lateral ethmoid); Me=mesethmoid; Pal=palatine; Par=parasphenoid; So=supraorbital.

cies of *Acanthopsoides* varies among individual species.

Fowler (1934) reported a small, intense dark spot at the base of the upper lobe of the caudal fin as characteristic of *A. gracilis*. This spot is composed of shallow epidermal chromatophores and of deeper lying chromatophores that surround the bases of some upper lobe caudal-fin rays. The spot is sometimes surrounded by an unpigmented area, forming an ocellus. Smith (1945) noted the presence of a similar spot in *Acantopsis choirorhynchos* and *Acanthopsoides gracilentus*. The distribution of this spot is in fact widespread among cobitines, and is also present in some members of the sister group to cobitids, the homalopterids.

Smith (1945) also reported a less intense spot at the base of the lower caudal lobe in *A. gracilentus*. This spot, unlike the upper lobe spot, is composed only of deep-lying chromatophores on some of the lower lobe caudal-fin rays, and is present only in some *Acanthopsoides* species. In larger specimens of these species the hypocordal musculature that overlays the bases of the caudal-fin rays is thick enough to mask the presence of the spot.

Fraser-Brunner's (1946) synonymization of *Acanthopsoides gracilentus* (=*Neacanthopsis gracilentus*) with *Cobitis taenia* was incorrect. The issues involved in this synonymization will be dealt with here by demonstrating that *Acanthopsoides* is related to cobitine genera other than *Cobitis* and that *A. gracilentus* is related to other *Acanthopsoides* species rather than being a synonym of *C. taenia*. The genera *Acanthopsoides* and *Acantopsis* share, among other features, a very unusual supraorbital, located largely anterior to the eye, that occupies the space of the lateral ethmoid of fishes of other cypriniform families. The supraorbital in these two genera extends anteriorly from the front of the orbit as a broad bony lamina. Its posterior edge forms the bony rim of the front of the orbit and the length of its anterior lamina varies from taxon to taxon in proportion to snout elongation. This unusual supraorbital has been illustrated for *Acantopsis* by Sawada (1982; p. 81, fig. 12). Its similarity to that of *Acanthopsoides gracilentus* (Fig. 2) is unmistakable. The supraorbital of these two genera is not like the supraorbital found in other cobitine genera, like *Cobitis*, which have the supraorbital located at the anterodorsal corner of the orbit, reduced in size, or even absent. *Acanthopsoides gracilentus* possesses an infraorbital lateral line canal and among fishes of the subfamily Cobitinae, only species of *Acanthopsoides*, *Acantopsis*, and *Somileptes* are known to possess an infraorbital lateral line canal. While possession of an infraorbital lateral line canal may be plesiomorphic among cobitid fishes generally, absence of one in several cobitine genera

Fig. 3. *Acanthopsoides gracilis*, ZSM 4002, 36.5 mm SL.

suggests they are all more closely related to *Cobitis*, which lacks the canal, than is *Acanthopsoides*. Finally, the physiogamy and color pattern of *Acanthopsoides* species are distinctive, and the shape and color pattern of *A. gracilentus* definitely fall in the pattern of other *Acanthopsoides* species, not in the pattern of *Cobitis* species.

Species accounts

Some *Acanthopsoides* species are very similar in appearance, but multivariate statistical comparisons (Table 3) between pairs of species found within the same river basin, or between pairs that look very similar but which live in different river basins, demonstrate they are significantly different from one another. When counts and measurements fail to provide a basis for easy separation, color pattern serves. Since differences among species of *Acanthopsoides* are sometimes subtle, having access to locality information and vertebral count and morphometric data from samples greatly facilitates identification to species. Thus the initial couplet in the following key is geographic.

Key to the species of *Acanthopsoides*

1a. *Acanthopsoides* from Borneo, Malaysia or peninsular Thailand .....Go to 2

1b. *Acanthopsoides* from areas of mainland Southeast Asia other than Malaysia or peninsular Thailand .....Go to 3

2a. Caudal fin with distinctive, dark, posteriorly pointing, v-shaped band; eye relatively large, steps into head about 6 times, into snout usually less than 2.5 times; snout short, usually steps into head more than 2.5 times; vertebral number typically 35 or less; from in and around Kapuas River basin, Kalimantan ..... *A. robertsi*, n. sp. (Fig. 10)

2b. Caudal fin without a posteriorly pointing v-shaped band; snout steps into head usually less than 2.5 times; eye relatively small, steps into head usually more than 6 times, into snout more than 2.5 times; vertebral number usually 36 or more; from throughout Borneo and from peninsular Malaysia and Thailand..... .....*A. molobrion*, n. sp. (Fig. 8)

3a. Snout long, steps into head 2 or fewer times; eye wholly, or almost wholly, in posterior half of head; vertebral number 37 or more; pleural rib number 17 or more; from the Salween, Chao Phraya and Mekong river basins ....*A. delphax*, n. sp. (Fig. 6)

3b. Snout short, steps into head more than 2 times; eye situated mostly in anterior half of head, vertebral number usually less than 37 .....Go to 4

4a. Dorsal fin set distinctly before pelvic fin origin; lateral blotch number usually 16 or more; dorsal bar number usually 15 or more; from the Chao Phraya and Mekong river basins .... *A. gracilentus.* (Fig. 5)

4b. Dorsal fin set over to slightly before pelvic fin origin; lateral blotch number usually less than 14; dorsal bar number usually less than 14; from the Chao Phraya and Mekong river basins .....Go to 5

5a. Snout pointed; head relatively short, about 5 times in length; from the Chao Phraya River basin .....*A. gracilis.* (Fig. 3)

5b. Snout rounded, head relatively long, usually less than 5 times in length; from the Mekong River basin .... *A. hapalias*, n. sp. (Fig. 7)

Acanthopsoides gracilis Fowler, 1934
(Figs. 3–4)

Acanthopsoides gracilis Fowler, 1934: 103–104 (type-locality Thailand; Chieng Mai).

Materials Examined

Holotype. ANSP 56999, 44.3 mm SL. Thailand:

Chieng Mai (=Chiang Mai; Chao Phraya River basin), Dec 1932, R. M. De Schauensee.

Paratypes. ANSP 57000–57006 (7), 57007 (1) Thailand: Chieng Mai (=Chiang Mai; Chao Phraya River basin), Dec 1932, R. M. De Schauensee.

Non-types. Chao Phraya River Basin—BMNH 1924.7.23:14 (1) Thailand: Me Wong (=Mae Nam Wong), 40 mi E of Um Pang (=Umphang). ANSP 57007 (1) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping). ANSP 57009–57027 (17) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping), 450 mi N of Bangkok, 75 mi E of Karenni (=Kayah State, Burma). ANSP 57028–57031 (4) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping), 450 mi N of Bangkok, 75 mi E of Karenni (=Kayah State, Burma). ANSP 57032–57033 (2) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping). ANSP 57034–36 (3) Thailand: Chieng Mai (=Chiang Mai), Meping (=Mae Nam Ping). ANSP 57037 (1) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping). ANSP 57038 (1) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping). ANSP 57039 (1) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping). ANSP 57040–57041 (2) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping). ANSP 57042 (1) Thailand: Chieng Mai (=Chiang Mai), Meping (= Mae Nam Ping), 450 mi N of Bangkok, 75 mi E of Karenni (Kayah State, Burma). ANSP 57043–57050 (16) Thailand: Chieng Mai (=Chianf Mai), Meping (=Mae Nam Ping). ANSP 60051 (2) Thailand: Chieng Mai (=Chiang Mai), Meping (=Mae Nam Ping). ANSP 60079 (1) Thailand: Chieng Mai (=Chiang Mai), Meping (=Mae Nam Ping). ANSP 60080 (1) Thailand: Chieng Mai (=Chiang Mai; Mae Nam Ping). UMMZ 209440 (6) Thailand: Uthaitani Prov. ZSM 4071 (1), Thailand: Mae Nam Tha, 2 km SSE of Ban Song Tha, 18°32′N, 99°14′E. ZSM 4101 (2), Thailand: Mae Nam Ping, 100 m S of Ban Mae Cha, 19°31′N, 99°38′E. ZSM 5199 (2) Thailand: Mae Nam Taeng, at Mae Taeng, 19°07′N, 98°58′E. ZSM 4002 (2), Thailand: Mae Nam Taeng, at Mae Taeng, 19°07′N, 98°57′E.

Differential Diagnosis. *Acanthopsoides gracilis* co-occurs with *A. gracilentus* and *A. delphax* in the Chao Phraya River basin. It can be distinguished from *A. gracilentus* by its more sharply pointed head (snout more rounded in *A. gracilentus*), larger eye (EYE averages 16.6% HL, 15.1% HL in *A. gracilentus*), shorter snout (SNT averages 40.3% HL, 42.5% HL in *A. gracilentus*), fewer number of times EYE steps into HL (HL/EYE averages 6.0, 6.7 in *A. gracilentus*), fewer number of mid-dorsal bars (mid-dorsal bars may number as many as 16 but are typically fewer than 14 in number, mid-dorsal bars may number as many as 20 but are typically more than 15 in number in *A. gracilentus*), fewer number of lateral blotches (lateral blotches may number as many as 14 but typically are fewer than 13 in number, lateral blotches may number as many as 30 but are typically greater than 16 in number in *A. gracilentus*), and by the positioning of the dorsal fin relative to the pelvic fins (the dorsal fin is set over to slightly in front of the pelvic fin origin, the dorsal fin is set distinctly in front of the pelvic fin origin in *A. gracilentus*). *Acanthopsoides gracilis* is easily distinguished from *A. delphax* by its eye position (the anterior margin of the eye falls in the anterior half of the head, the anterior margin of the eye falls in the posterior half of the head in *A. delphax*), its much shorter snout (SNT averages 40.3% HL, 50.8% HL in *A. delphax*), and by its longer post-ocular distance (POL averages 27.2% HL, 18.1% HL in *A. delphax*).

Description. The morphometry and general characteristics of the color pattern of *Acanthopsoides gracilis* are illustrated in Figure 3; comments presented here will be limited to those which facilitate identification of the species. Means, and variation about the mean, of selected vertebral counts, and of pleural rib number, of *Acanthopsoides* species are presented in Table 2. Means, and variation about the mean, of selected mensurable variables, and of selected ratios, are presented for these species in Table 3.

The head of *Acanthopsoides gracilis* is long and pointed, being almost lanceolate in lateral view. The snout is comparatively short and the eye comparatively large, the result of which is a low SNT/EYE (Table 3). The eye is positioned such that it is almost wholly in the anterior half of the head. The position of the eye is reflected in post-ocular length, POL averaging 27.2% of HL. On average EYE steps into POL 1.6 times. The suborbital spine reaches posteriorly to about even with the front margin of the pupil.

The dorsal fin origin of *A. gracilis* is located over, or slightly in front of, the origin of the pelvic-fins. This is reflected in the number of vertebrae between the locations of the dorsal and pelvic fins (average= 1.8; dorsal and pelvic fin position relative to each other along the vertebral column determined as indicated in Methods). The illustration of *A. gracilis* that accompanied Fowler's description of the species (1934) showed the dorsal fin located behind the pelvic origin with the dorsal fin origin over the base of the last pelvic fin ray. The dorsal fin of the holotype of *A. gracilis* is located further posterior relative to the pelvic fins than that of most other

specimens of the species (its dorsal fin origin is behind the pelvic fin origin) but no specimen examined for this study exhibited a dorsal fin location relative to the position of the pelvic fins as illustrated by Fowler (see also Nalbant, 1963).

The lateral line of *Acanthopsoides gracilis* is incomplete. It extends along the side of the body only to a little more than half way between the nape and the dorsal fin origin, as can be seen in Fig. 3. Fowler (1934) reported a complete lateral line in *A. gracilis* but examination of the holotype and additional materials of the species reveals Fowler's statement to be in error (see also Nalbant, 1963).

Average number of post-weberian vertebrae for *Acanthopsoides gracilis* is 36.9. Of these, caudal vertebrae outnumber abdominal vertebrae (Table 2; if total vertebrae rather than post-weberian vertebrae are considered, then abdominal vertebrae outnumber caudal vertebrae). Number of pleural ribs is less than number of abdominal vertebrae.

The color pattern illustrated in Fig. 3 is generally indicative of that described above for the entire genus. The intense spot at the base of the upper lobe of the caudal fin described by Fowler (1934) is clearly in evidence, as is the fainter spot at the base of the lower lobe of the caudal fin described by Smith (1945).

Distribution. *Acanthopsoides gracilis* is at present known only from the Chao Phraya River basin, Thailand. Two other species of *Acanthopsoides*, *A. gracilentus* and *A. delphax*, are known to co-occur in the Chao Phraya basin with *A. gracilis* (Fig. 4). Collections of these species are few but it does not appear that these three species are broadly sympatric within the basin, and it isn't known if they live syntopically. All three species, however, have been collected from the Mae Taeng at Taeng.

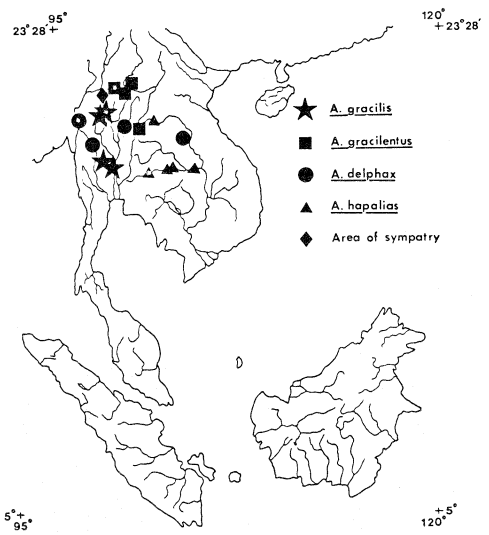

Fig. 4. Known distribution of *Acanthopsoides gracilis*, *A. gracilentus*, *A. delphax*, and *A. hapalias*. Open symbols represent the type locality; symbols represent physical locals, not necessarily number of individual collections.

Acanthopsoides gracilentus (Smith, 1945), new combination (Figs. 1–2, 4–5)

Neacanthopsis gracilentus Smith, 1945; 297–298 (type-locality: Thailand; Meping River N. of Chiengmai).

Materials Examined

Holotype. USNM 107952, Thailand: Meping River (=Mae Nam Ping, Chao Phraya River basin) N of Chiengmai (=Chiang Mai), 28 Jan 1932, H. M. Smith (Riley (1938) reports Smith was at Chiengdao (=Chiang Dao) on this date).

Paratypes. USNM 109752, Data as for holotype. USNM 109751, Thailand: Meping River (=Mae Nam Ping, Chao Phraya River basin) at Chiengdao (=Chiang Dao), 25 Apr 1935, H. G. Deignan.

Non-types. Mekong River Basin—ANSP 56825 (1), Thailand: Mekong River, at Chieng San (=Chiang Saen). USNM 229332 (39), Thailand: Mae Nam Fang, 34 km S of Fang on the road from Chiengmai (=Chiang Mai). USNM 229333 (4), Thailand: Mae Nam Kok, at Thaton (=Tha Ton). ANSP 56825 (1), Thailand: Mekong River, at Chieng San (=Chiang Saen). ZSM 5229 (1), Thailand: Mekong River basin, market at Fang. ZSM 4038 (1), Thailand: Mae Nam Lao, at 62 km and 65 km along road from Chieng Mai (=Chiang Mai) to Chieng Rai (=Chiang Rai). ZSM 5218 (2), Thailand: Mae Nam Fang, 35 km S of Fang on road to Chiang Mai. ZSM 5032 (1), Thailand: Nam Man, 2 km upstream from Amphoe Dan Sai, 17°16′N, 101°09′E.

Chao Phraya River Basin—ZSM 5199 (1), Thailand: Mae Nam Taeng, at Mae Taeng, 19°07′N, 98°57′E. ZSM 4002 (5), Thailand: Mae Nam Taeng, at Mae Taeng, 19°07′N, 98°57′E.

Differential Diagnosis. *Acanthopsoides gracilentus* co-occurs with *A. gracilis* and *A. delphax* in the Chao Phraya River basin, and with *A. hapalias* in the Mekong River basin. Features distinguishing *A. gracilentus* from *A. gracilis* have been listed above under the diagnosis of *A. gracilis*. *Acanthopsoides gracilentus* can be distinguished from *A. delphax* by

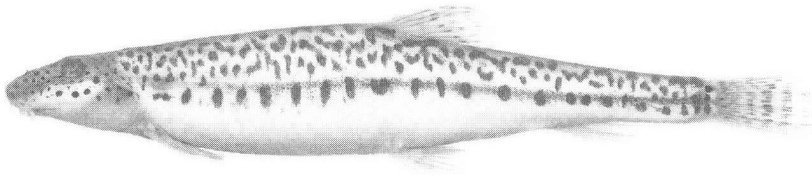

Fig. 5. *Acanthopsoides gracilentus*, USNM 229332, 54.4 mm SL.

eye position (the anterior margin of the eye falls in the anterior half of the head, the anterior margin of the eye falls in the posterior half of the head in *A. delphax*), by its much shorter snout (SNT averages 42.5% HL, 50.8% in *A. delphax*), and by its much longer post-ocular distance (POL averages 28.0% HL, 18.1% HL in *A. delphax*). *Acanthopsoides gracilentus* can be distinguished from *A. hapalias* by its shorter head (HL averages 20.2% SL, 21.6% SL in *A. hapalias*), by its shorter pre-dorsal and pre-pelvic lengths (PDL averages 54.1% SL and PPL averages 55.6% SL, PDL averages 56.7% SL and PPL averages 57.6% SL in *A. hapalias*), by its longer snout (SNT averages 42.5% HL, 39.1% HL in *A. hapalias*), by its smaller eye (EYE averages 15.1% HL, 17.8% HL in *A. hapalias*), and by the greater number of times its eye steps into SNT and HL (SNT/EYE averages 2.8 and HL/EYE averages 6.7, SNT/EYE averages 2.2 and HL/EYE averages 5.6 in *A. hapalias*).

Description. The morphometry and general characteristics of the color pattern of *Acanthopsoides gracilentus* are illustrated in Fig. 5; comments presented here will be limited to those which facilitate identification of the species.

The head of *Acanthopsoides gracilentus* is egg-shaped in lateral view. Its snout is more blunt than the snout of *A. gracilis* or *A. delphax*, the two species that co-occur with it in the Chao Phraya River basin, but is shaped like that of *A. hapalias*, the species that co-occurs with *A. gracilentus* in the Mekong River basin. The snout of *A. gracilentus* is comparatively long, averaging 42.5% HL, and is exceeded in length only by that of *A. delphax*. *Acanthopsoides gracilentus* possesses a relatively small eye (Table 3). Even with a comparatively long snout, the eye is positioned almost wholly in the anterior half of the head. The suborbital spine extends posteriorly to from beneath the front edge of the eye to the middle of pupil.

The dorsal fin of *Acanthopsoides gracilentus* is positioned slightly but distinctly before the pelvic fin origin, and on average, its pre-dorsal length is shorter than that of any *Acanthopsoides* species of mainland Southeast Asia north of peninsular Thailand. The advanced positioning of the dorsal fin is reflected in its position as measured by counting vertebrae (Table 2), and also by the average number of vertebrae between the dorsal and pelvic fin origins (Table 2; determined as indicated in Methods).

The lateral line of *Acanthopsoides gracilentus* is incomplete. It terminates at about half way between the tip of the snout and the dorsal fin origin. Males have longer pectoral fins than females. The point at which the lateral line ends is about at the tip of the pectoral fin of males, but in females, the point at which it ends is beyond the tip of the pectoral fin.

The number of post-weberain vertebrae averages 36.5 in *Acanthopsoides gracilentus*. Caudal vertebrae outnumber abdominal vertebrae among post-weberian vertebrae (Table 2).

The color pattern of *Acanthopsoides gracilentus* (Fig. 5) is distinctive among species of *Acanthopsoides* for the high number of mid-dorsal bars and lateral blotches that contribute to it. The number of lateral blotches varies greatly among individuals, ranging from as high as 30 to as low as 13, but of a sample of 22 individuals, 50% had 20 or more lateral blotches and over 80% had 16 or more. The number of mid-dorsal bars varies among individuals too, but not as much as does the number of lateral blotches. Mid-dorsal bar number ranged from 21 to 14, with 90% of individual examined possessing 15 or more mid-dorsal bars. The relation between the number of mid-dorsal bars and lateral blotches is different in this species too. Number of lateral blotches is greater than number of mid-dorsal bars. All other *Acanthopsoides* species possess a greater number of mid-dorsal bars than lateral blotches.

Distribution. *Acanthopsoides gracilentus* inhabits some of the upper reaches of the Mae Nam Ping, a major tributary of the Chao Phraya River in north-

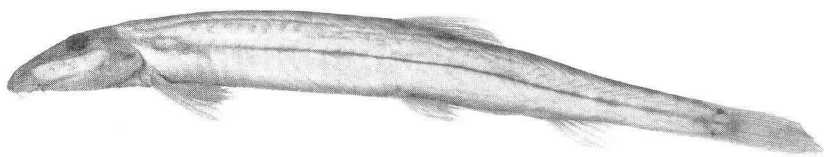

Fig. 6. *Acanthopsoides delphax*, new species, holotype, USNM 229043, 51.6 mm SL.

western Thailand (Fig. 4). Two other species of *Acanthopsoides*, *A. gracilis* and *A. delphax* also live in the Mae Nam Ping in northwestern Thailand with *A. gracilentus*. *Acanthopsoides gracilentus* also inhabits tributaries of the Mekong River in northwestern Thailand. *Acanthopsoides hapalias* also lives in the Mekong River basin, at least as far north as the Vientiane area. It isn't known if the two species are sympatric.

Acanthopsoides delphax, sp. nov.
(Figs. 4, 6)

Materials Examined

Holotype. USNM 229043, 51.5 mm SL. Thailand: Salween River at Mae Sahm (W of Mae Sariang), 30 Apr 1973, T. R. Roberts.

Paratypes. Salween River Basin—USNM 305219 (1), Data as for holotype. ZSM 4932 (3), Thailand: Mae Nam Moei, 5 km W Amphoe Mae Sot, 7 Apr 1985, C. M. Kottelat.

Non-types. Mekong River Basin—T. R. Roberts personal collection, uncataloged (1), Thailand: Mekong River about 1 km downstream from Pak Ing, 13 Jan 1989.

Chao Phraya River Basin—USNM 109737 (2), Thailand: Mae Nam Yom at Prae. ZSM 5199 (16) Thailand: Mae Nam Taeng, at Mae Taeng, 19°07′N, 98°58′E. ZSM 4002 (33), Thailand: Mae Nam Taeng, at Mae Taeng, 19° 07′N, 98°57′E.

Differential Diagnosis. *Acanthopsoides delphax* co-occurs with *A. gracilis* and *A. gracilentus* in the Chao Phraya River basin, and with *A. gracilentus* and *A. hapalias* in the Mekong River basin. Features that distinguish it from *A. gracilis* and *A. gracilentus* have been discussed above under their respective differential diagnoses. A number of attributes of *A. delphax* make it unique in the genus. Two attributes are especially noteworthy. No other species of *Acanthopsoides* has the eye wholly in the posterior half of the head as does *A. delphax*, and it possesses more vertebrae than any other *Acanthopsoides* species (post-weberian vertebrae number averages 38.4, highest average number of post-weberian vertebrae for any other *Acanthopsoides* species is 36.9 (for *A. gracilis*)).

Description. The morphometry and general characteristics of the color pattern of *Acanthopsoides delphax* are illustrated in Fig. 6; comments presented here will be limited to those which facilitate identification of the species.

Acanthopsoides delphax is in many respects the most distinctive species of *Acanthopsoides*. It looks more like a species of *Acantopsis* than does in any other *Acanthopsoides* species. A long snout and the more posteriorly positioned eye of *A. delphax* contribute to its appearance of being more *Acantopsis*-like than other species of *Acanthopsoides*. Overall, its head shape is lanceolate in lateral view; it has a long, pointed snout. Snout length averages greater than 50% HL, much more than for any other species of *Acanthopsoides* (Table 3). EYE steps into SNT an average 3.3 times. Given that EYE of *A. delphax* is not much different than EYE of other species in the genus (Table 3), the length of the snout must be longer in relative terms than the length of the snout in other species of *Acanthopsoides*. The position of the eye of *A. delphax* is shifted rearward compared to eye position in other species in the genus. The eye of *A. delphax* is positioned wholly in the posterior half of the head. Its post-ocular length averages just 18.1% HL, and POL/EYE averages just 1.2. The suborbital spine extends posteriorly to about even with the front edge of the pupil.

Large specimens (>50 mm SL) of *Acanthopsoides delphax* are the only known specimens of *Acanthopsoides* with a complete lateral line, and in general it is the only species in the genus known to possesses lateral line canal elements on the rear portion of its body. The lateral line is interrupted along the middle portion of the torso in smaller specimens. The anterior section ends at about 2/3 of the distance between the nape and the dorsal fin origin. The posterior section begins as far forward as the middle of the anal fin but more commonly is confined to the caudal peduncle. The materials at hand do not

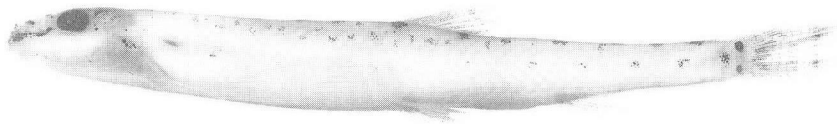

Fig. 7. *Acanthopsoides hapalias*, new species, uncataloged from Tyson Roberts' personal collection, 27.5 mm SL.

reveal how the gap between the anterior and posterior sections of the lateral line is completed in large individuals.

Acanthopsoides delphax possesses more vertebrae than other *Acanthopsoides* species (Table 2), and the relations between the numbers of kinds of vertebrae are different than for other species in the genus. Unlike other species in the genus it possesses more abdominal post-weberian vertebrae than caudal post-weberian vertebrae. Given that the number of post-weberian caudal vertebrae it possesses is the same as that for other *Acanthopsoides* species (Table 2), the increase in vertebral number must be due to a greater number of abdominal vertebrae. Specificly, the data suggest that *A. delphax* possesses two more abdominal vertebrae than other species in the genus. It possesses two more pleural ribs than its congeners too (Table 2).

Materials of *Acanthopsoides delphax* which reveal its color pattern are known only from the upper Mae Nam Ping. In that population, mid-dorsal bars outnumber lateral blotches. Size of lateral blotches varied from smaller than the eye to a little larger than eye size. An intense spot is found at the base of the upper lobe of the caudal fin, a less intense spot at the base of the lower lobe of the caudal fin.

Distribution. *Acanthopsoides delphax* has a wide distribution. It is known from the Salween River basin, Thailand and Burma, from the Chao Phraya River basin, northwestern Thailand, and from the Mekong River basin, north central Thailand. It is the only known species of *Acanthopsoides* in the Salween basin, but co-occurs with *A. gracilis* and *A. gracilentus* in the Chao Phraya River basin, where all three species are sympatric in the upper reaches of the Mae Nam Ping. *Acanthopsoides gracilentus* and *A. hapalias* also occur in the Mekong River basin with *A. delphax*, but it isn't known if any of the species are sympatric there.

Etymology. The epithet *delphax* is a noun in apposition. It means young pig and the name is in reference both to the small size of the species and to its similarity in appearance to the species Henry Fowler knew as *Acantopsis choirorhynchos*.

Acanthopsoides hapalias, sp. nov.
(Figs. 4, 7)

Materials Examined

Holotype. USNM 271723, Thailand: Nakhon Ratchasima Prov., Mekong River basin, Lam Nam Mun (=Mae Nam Mun) about 2 km downstream from Phimai, 15°14′N, 102°31′E, 29 Jan 1971, Water Borne Disease Project.

Paratypes. USNM 305220 (9), Data as for holotype. CAS 61906 (4), Thailand: Ubon Prov., Mekong River basin, fish market at Ubon Ratchanthani, 28 Jun–02 Jul 1985, T. Roberts.

Non-types. Mekong River Basin—USNM 271711 (7), Thailand: Nong Khai Prov., Mekong River at Wat Hin Peng, about 15 km upstream from Vientiane, 17°58′N, 102°26′E. USNM 271110 (8), Thailand: Surin Prov, Lam Phlapphla at hwy. 14, 17 km NE of Thum (Mae Nam Mun drainage), 15°26′N, 103°45′E. USNM 271715 (17), Thailand: Roi Et Prov., Lam Sieo Yai at hwy. 214, 4 km S of Suwannaphum (Mae Nam Mun drainage), 15°35′N, 103°50′E.

Differential Diagnosis. *Acanthopsoides hapalias* co-occurs with *A. gracilentus* and *A. delphax* in the Mekong River basin. Features which specifically distinguish it from *A. gracilentus* are discussed above under the differential diagnosis of *A. gracilentus*. Features that distinguish *A. hapalias* from *A. delphax* are listed above under the differential diagnosis for *A. delphax* (these features distinguish *A. delphax* from all other species of *Acanthopsoides*). *Acanthopsoides hapalias* is distinctive among all species of *Acanthopsoides* from mainland Southeast Asia for its large eye (EYE averages 17.8% HL, EYE averages 16.6% HL in *A. gracilis*, the species with the next largest EYE), its short snout (SNT averages 39.1% HL, SNT averages 40.1% HL in *A. gracilis*, the species with the next shortest SNT), and its long pre-dorsal and pre-pelvic length (PDL averages 56.7% SL and PPL averages 57.6% HL, PDL averages 54.9% SL in *A. delphax* and *A. gracilis*, the species with the next

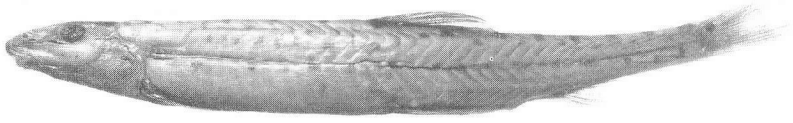

Fig. 8. *Acanthopsoides molobrion*, new species, hololtype, RMNH 31273, 45.1 mm SL.

longest PDL and PPL averages 55.7% SL in *A. delphax*, the species with the next longest PPL).

Description. The morphometry and general characteristics of the color pattern of *Acanthopsoides hapalias* are illustrated in Fig. 7; comments presented here will be limited to those which facilitate identification of the species.

Acanthopsoides hapalias possesses a head profile like that of *A. gracilentus*, with a somewhat rounded snout. Its snout length is on average shorter than that of any other species in the genus from mainland Southeast Asia (Table 3). Its eye is comparatively large, on averaging stepping into HL only 5.6 times despite it also possessing a comparatively long head. Like all other species of *Acanthopsoides* except for *A. delphax*, the eye of *A. hapalias* is positioned almost wholly in the anterior half of the head. The suborbital spine typically extends as far back as a vertical line through the middle of the pupil of the eye.

The dorsal and pelvic fins of *Acanthopsoides hapalias* are set further back along the body than those of other species of *Acanthopsoides* (Table 3). The position of the dorsal fin of *A. hapalias* relative to its pelvic fins is similar to that of *A. gracilis*. It is positioned over to slightly before the pelvic fin origin. This is reflected in the low number of vertebral segments between the position at which the first dorsal-fin pterygiophore intersects the vertebral column and the position at which a vertical from the anterior part of the pelvic girdle intersects the vertebral column (Table 2).

The lateral line of *Acanthopsoides hapalias* is incomplete, extending only a little way beyond length of the pectoral fin.

The average number of post-weberian vertebrae of *Acanthopsoides hapalias* is 35.5, the lowest average of all species of the genus from mainland Southeast Asia (Table 2). Possession of fewer abdominal vertebrae than other *Acanthopsoides* species from the mainland (Table 2) acccounts for the difference among them in average number of post-weberian vertebrae. Like most other species of *Acanthopsoides*, *A. hapalias* possesses more caudal post-weberian vertebrae than abdominal post-weberian vertebrae.

Available materials of *Acanthopsoides hapalias* are not of sufficient quality for accurate description of its color pattern. Enough detail is apparent to report that lateral blotch and dorsal bar number are fewer than those of *A. gracilentus*, as is the number of caudal bands. Size of lateral blotches appears to be consistently smaller than eye size. A spot is present at the base of the upper caudal fin lobe, and at the base of the lower caudal fin lobe as well in smaller specimens.

Distribution. *Acanthopsoides hapalias* occurs in the lower Mekong River basin, as far north as Vientiane (Fig. 4). Taki (1974) reported on material identified as *A. gracilis* from Luangphrabang, Laos, north of Vientiane. This material was not examined for this study but if it is the same species as that in his figure, then *A. hapalias* occurs north of Vientiane. *Acanthopsoides gracilentus* is found in the Mekong River basin in the region of Chiang Saen, Thailand, and in the Nam Man drainage upstream from Vientiane. Whether or not these two species are sympatric anywhere in the basin isn't known for sure, but if Taki's materials from Luangphrabang, Laos are indeed *A. hapalias* and not *A. gracilentus*, the ranges of the two species do overlap in the Mekong River basin upstream from Vientiane.

Etymology. The epithet *hapalias*, a noun in apposition, means sucking pig. It is proposed in reference to the small size of the species and to the similarity in appearance of the species to the species Henry Fowler knew as *Acantopsis choirorhynchos*.

Acanthopsoides molobrion, sp. nov.
(Figs. 8–9)

Materials Examined

Holotype. RMNH 31273, 45.1 mm SL. Indonesia: Borneo (=Kalimantan Timur), River Bo (=Sungai Boh, Mahakam River basin), 1900, A. W. Nieuwenhuis.

Paratypes. RMNH 30347 (6). Data as for holotype.

Non-types. Kapuas River basin—CAS 49343 (6), Indonesia: (Borneo) Kalimantan Barat, Sungai Melawi and

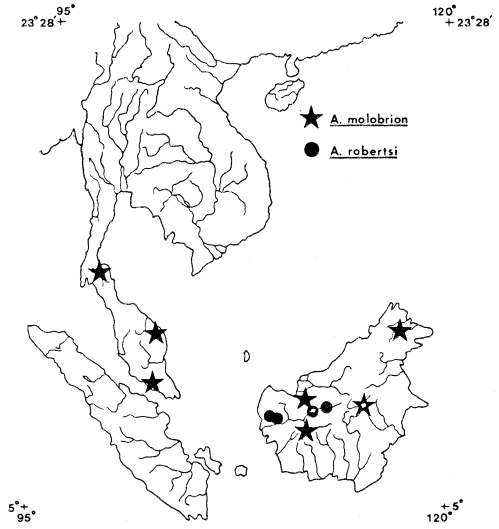

Fig. 9. Known distribution of *Acanthopsoides molobrion* and *A. robertsi*. Open symbols represent the type locality; symbols represent physical locals, not necessarily number of individual collections.

mouth of Sungai Pinoh at Nangapinoh, 0°19′30″N, 111° 44′E.

Kinabatangan River basin—FMNH 98698 (2), Malaysia: Sabah (=N. Borneo), Kinabatangan Dist., unnamed trib. of Kinabatangan River at Deramakot, 5°18′N, 117° 33′E.

Baleh River basin—FMNH 68156 (3), Malaysia: Sarawak, Third Div., trib. of Baleh River.

BMNH 1990.6.19:1 (1), Malaysia: Johor, near Bekok, 1984, A. and B. Brown.

Sungai Teregganu basin—BMNH 1980.10.10:33 (1), Malaysia: Teregganu, Sungai Tersat, at trib. of Sungai Teregganu.

Mae Nam Tapi basin—ZSM 5164 (1), Thailand, Mae Nam Tapi near Phraseng, 8°34′N, 99°15′E.

Differential Diagnosis. *Acanthopsoides molobrion* co-occurs with *A. robertsi* in the Kapuas River basin. *Acanthopsoides molobrion* is distinguished from *A. robertsi* by its longer head (HL averages 22.1% SL, 20.5% SL in *A. robertsi*), its longer snout (SNT averages 42.3% HL, 38.9% HL in *A. robertsi*), its shorter post-ocular length (POL averages 25.2% HL, 30.7% HL in *A. robertsi*), and its longer predorsal and pre-pelvic length (PDL averages 54.2% SL and PPL 55.6% SL, PDL averages 52.6% SL and PPL averages 53.5% SL in *A. robertsi*).

Description. The morphometry and general characteristics of the color pattern of *Acanthopsoides molobrion* are illustrated in Fig. 8; comments presented here will be limited to those which facilitate identification of the species.

The head of *Acanthopsoides molobrion* is pointed in lateral view, and is comparatively long (Table 3). The snout of *A. molobrion* is comparatively long too, especially compared to that of *A. robertsi*, the species it co-occurs with in the Kapuas River basin, Kalimantan Barat. The eye is positioned largely in the anterior half of the head. Among species of *Acanthopsoides* with the eye positioned in the anterior half of the head, *Acanthopsoides molobrion* has the shortest post-ocular length. The suborbital spine extends posteriorly to about the front of the pupil.

The dorsal fin of *Acanthopsoides molobrion* is set in front of to over the pelvic fins, and the average number of vertebrae between the dorsal and pelvic fins is 2.5 (Table 2; dorsal and pelvic fin positions determined as set out in Methods). The dorsal fin origin is set distinctly more than half way along SL.

As in most other species in the genus, the lateral line of *Acanthopsoides molobrion* is incomplete. It extends past the length of the pectoral fin to about 2/3 the distance between the nape and dorsal fin origin.

Average number of post-weberian vertebrae is 36.4 for *Acanthopsoides molobrion*, and it possesses more caudal post-weberian vertebrae than abdominal post-weberian vertebrae.

The color pattern of *Acanthopsoides molobrion* (Fig. 8) is similar to that of *A. hapalias*, in that lateral blotches are not always prominent. The number of mid-dorsal bars varied from 15 to 10, but most specimens had 13 or fewer mid-dorsal bars. Three bands mark the caudal fin.

Distribution. *Acanthopsoides molobrion* is widely distributed, occurring throughout Borneo, Malaysia, and on peninsular Thailand (Fig. 9). The type and paratypes of the species are from the Mahakam River basin of central and eastern Borneo. Only a few specimens from each locality are known for this species. Additional materials may show this species to be a complex of species. *Acanthopsoides molobrion* co-occurs with *A. robertsi* in the Kapuas River basin, Kalimantan Barat.

Etymology. The epithet *molobrion* means piglet of wild swine. It is a noun in apposition and is suggested in reference to the small size of the species and to the similarity in appearance between the species and species Henry Fowler knew as *Acantopsis choirorhynchos*.

Fig. 10. *Acanthopsoides robertsi*, new species, holotype, CAS 49345, 35.1 mm SL.

Acanthopsoides robertsi, sp. nov.
(Figs. 9–10)

Materials Examined

Holotype. CAS 49345, 35.1 mm SL. Indonesia: (Borneo) Kalimantan Barat, small oxbow off Kapuas River opposite Empangau, 124 km NE Sintang, 0°44′N, 112°23′E, 13 Aug 1976, T. Roberts, and S. Woerjoatmodjo.

Paratypes. Kapuas River basin—CAS 49344 (15), Indonesia: (Borneo) Kalimantan Barat, Sungai Mandai Ketchil near its confluence with Kapuas mainstream 18 km WSW of Putussibau, 0°48′N, 112°47′E, 11 Aug 1976, T. R. Roberts and S. Woerjoatmodjo. USNM 230261 (11), Data as for CAS 49344. UMMZ 209902 (5), Data as for CAS 49344. ANSP 152021 (9), Data as for CAS 49344.

Non-types. Kapuas River drainage—CAS 49512 (5), Indonesia: (Borneo) Kalimantan Barat, small stream flowing into Sungai Mandai 2–3 mi upstream from confluence with Kapuas mainstream, 17 mi WSW of Putussibau, 0°47′N, 112°48′E. CAS 49346 (1), Indonesia: (Borneo) Kalimantan Barat, small stream 1 km up Sungai Tajan, 87 km E of Pontianak, 0°2′S, 110°0′E. BMNH 1982.3.29:127–131 (5), Indonesia: (Borneo) Kalimantan Barat, small tributary stream of Sungai Mandai 2–3 mi upstream from confluence with Kapuas mainstream, 17 km WSW of Putussibau, 0°47′N, 112°48′E.

Sungai Landak drainage—CAS 49342 (2), Indonesia: (Borneo) Kalimantan Barat, Sungai Belantian 6 km by road E of Ngabang, 0°22′N, 109°59′33″E.

Differential Diagnosis. *Acanthopsoides robertsi* co-occurs in the Kapuas River basin with *A. molobrion*. Features specificly distinguishing it from *A. molobrion* are listed above under the differential diagnosis of *A. molobrion*. *Acanthopsoides robertsi* is unique among all its congeners for its long post-ocular length (POL averages 30.7% HL, 28.7% HL in *A. hapalias*, the species with the next longest POL), and for its short pre-dorsal and pre-pelvic length (PDL averages 52.6% SL and PPL averages 53.5% SL, PDL averages 54.1% SL in *A. gracilentus*, the species with next shortest PDL and PPL averages 55.5% SL in *A. gracilis*, the species with the next shortest PPL). *Acanthopsoides robertsi* also possesses fewer post-weberian vertebrae and fewer pleural ribs than any other species of *Acanthopsoides* (post-weberian vertebrae number averages 34.6 and number of pleural ribs averages 13.5, post-weberian vertebrae number averages 35.5 in *A. hapalias*, the species with the next fewest post-weberian vertebrae and number of pleural ribs averages 14.8 in *A. molobrion*, the species with the next fewest pleural ribs).

Description. The morphometry and general characteristics of the color pattern of *Acanthopsoides robertsi* are illustrated in Fig. 10; comments presented here will be limited to those which facilitate identification of the species.

The shape of the head of *Acanthopsoides robertsi* is similar to that of *A. gracilentus* of Thailand in that it has a comparatively blunt snout. The snout of *A. robertsi* is short. Even with a relatively short HL, SNT steps into HL a comparatively high 2.6 times (Table 3). The eye of *A. robertsi* is positioned almost wholly in the anterior half of the head. Its post-ocular length is the longest of all species of *Acanthopsoides*, in part a consequence of a short snout. EYE steps into post-ocular length 1.8 times in *A. robertsi*, only *A. gracilentus* which possess the smallest eye of all *Acanthopsoides* species has a larger POL/EYE ratio. The suborbital spine extends posteriorly to a line at about the middle of the pupil.

The dorsal and pelvic fins of *Acanthopsoides robertsi* are set further forward along the body than the dorsal and pelvic fins of other species in the genus (Table 3). The short pre-dorsal and pre-pelvic length is reflected in the positioning of these fins along the vertebral column (Table 2). Pre-anal fin length was not measured but anal fin position along the vertebral column was, and anal fin position along the vertebral column is shorter than for any other species in the genus. Even though the dorsal and pelvic fins of *Acanthopsoides robertsi* are positioned further forward than for other *Acanthopsoides* species, the relationship between the fins is the same as that for several other members of the genus. The dorsal fin is set in front of to over the pelvic fins, and the average number of vertebrae between the dorsal

fin and the pelvic fins is 2.4 (Table 2; fin positions determined as set out in Methods).

The lateral line of *Acanthopsoides robertsi* is incomplete. It extends along the body to only about 1/2 the length of the pectoral fins.

Post-weberian vertebral number of *Acanthopsoides robertsi* averages only 34.6, the fewest of any *Acanthopsoides* species. Like most other *Acanthopsoides* species, *A. robertsi* possesses more caudal post-weberian vertebrae than abdominal post-weberian vertebrae, but relations between abdominal and caudal vertebral elements of *Acanthopsoides* suggest that *A. robertsi* possesses one fewer vertebrae of each kind than other *Acanthopsoides* species (Table 2). Along with possession of fewer abdominal vertebrae than other *Acanthopsoides* species, *A. robertsi* possesses fewer pleural ribs on average than other species in the genus. The relation between the number of pleural ribs and the number of abdominal vertebrae is maintained however, there generally being 2 fewer pleural ribs than abdominal vertebrae. Another unusual feature of *A. robertsi* is that even though it generally possesses fewer caudal vertebrae than other species in the genus, it possesses more peduncular vertebrae, presumably a consequence of the advanced positioning of the anal fin since peduncular vertebrae are counted as those caudal vertebrae fully posterior to the last anal fin pterygiophore.

The color pattern of *Acanthopsoides robertsi* (Fig. 10) generally conforms to the generic pattern. Lateral blotches are not always prominent. The number of mid-dorsal bars varied from 20 to 13, but most individuals possessed 14 or more mid-dorsal bars. The color pattern of the caudal fin of *A. robertsi* appears unique for the genus. *Acanthopsoides robertsi* possesses a prominent spot at the base of the upper lobe of the caudal fin that is ringed by an unpigmented area. The unpigmented ring intrudes on a band at the base of the fin so that only the lower half of the fin is banded at its base. A strong, lunate band occurs about half way along the length of the caudal fin (Fig. 10). A few caudal rays bear dark markings even more distally, but not so as to form a third band and these later marks appear only in specimens which show an intensified color pattern overall. Interestingly, pigmentation of the two anterior bands is not confined only to fin rays as is usual for *Acanthopsoides* species, but also extends onto the interradial membranes of some specimens.

Distribution. *Acanthopsoides robertsi* is known only from the Kapuas River basin and adjacent area, Kalimantan Barat. It occurs with *Acanthopsoides molobrion* in the Kapuas River, Kalimantan Barat (Fig. 9).

Etymology. The epithet *robertsi* is proposed to honor Tyson Roberts. So far as is known, *Acanthopsoides robertsi* is restricted to the Kapuas River basin, and adjacent regions, of Kalimantan Barat. It is only through Tyson Roberts' ichthyological survey of the Kapuas River basin that the species became known.

Discussion

Relationships. Few authors have speculated on the relationships of *Acanthopsoides*, perhaps because the fishes are little known with, until recently, comparatively few specimens extant in museum collections and because literature concerning them is obscure. Both Fowler (1934) and Smith (1945) recognized a similarity in appearance between *Acanthopsoides* (as recognized herein) and *Acantopsis*. Beyond this, only Nalbant (1963) and Sawada (1982) have commented directly on the possible generic relationships of *Acanthopsoides*. Materials of the genus available to these workers were limited, precluding in depth study of internal anatomy. Nalbant suggested *Acanthopsoides* was an offshoot of *Acantopsis*. Sawada suggested the genus was more closely related to *Cobitis* and other cobitine genera than to *Acantopsis*. Neither of these authors presented much evidence to support their hypothesis. The problem of the generic relationships of *Acanthopsoides* is under further study but the information on the supraorbital, infraorbital lateral line canal and color pattern presented above in the discussion of Fraser-Brunner's synonymization of *Neacanthopsis gracilentus* with *Cobitis taenia* indicates that Nalbant is correct, and that the similarity between *Acanthopsoides* and *Acantopsis* observed by Fowler and Smith is one of phyletic relationship. Relationships among the species of *Acanthopsoides* are under study too, particularly with regard to Southeast Asian biogeography.

Biogeography. Known *Acanthopsoides* species are distributed from the Salween River basin, Burma, east to the Mekong River basin of Thailand and Laos, south through the peninsular Thailand and Malaysia, and further eastward to throughout Borneo. Reflection on the history of discovery of the distribution of *Acanthopsoides* does not suggest that knowledge of it has reached a point of stability, that

is, it does not suggest we know yet the limits of the distribution of the genus.

The development of knowledge of the distribution of the genus *Acanthopsoides* can be summarized as continual discovery of a wider range than previously known. Fowler (1934) and Smith (1945) each know

Table 1. Results of MANOVA comparisons between pairs of *Acanthopsoides* species that co-occur in the same river basin. The hypothesis tested in each comparison was for the equality of mean vectors; Wilk's lambda was used to generated an approximate F value. The analyses were performed with the GENSTAT package (Numerical Algorithm Group) of programs run on a VAX minicomputer. The probability below which that associated with each F value falls is reported (leading to a rejection of the hypothesis of equality of mean vectors), or in the two cases of a nonsignificant F value, the range into which the associated probability falls; the degrees of freedom for each comparison are reported below each probability value. The half of the table above the upper left-to-lower right diagonal reports the comparisons based on the various vertebrae counts. The half of the table below the upper left-to-lower right diagonal reports the comparisons based on morphometric ratios.

	gracilis n=86	*gracilentus* n=27	*delphax* n=32	*hapalias* n=43	*molobrion* n=15	*robertsi* n=46
gracilis n=11	—	.005>p 7 and 105	.001>p 7 and 110	—	—	—
gracilentus n=11	.1>p>.05 9 and 12	—	.001>p 7 and 51	.001>p 7 and 62	—	—
delphax n=16	.001>p 9 and 17	.001>p 9 and 17	—	—	—	—
hapalias n=10	.25>p>.1 9 and 11	.001>p 9 and 11	—	—	.001>p 7 and 50	—
molobrion n=15	—	—	—	.001>p 9 and 15	—	.001>p 7 and 52
robertsi n=10	—	—	—	—	.001>p 9 and 15	—

Table 2. Vertebrae counts, positioning of fins in terms of the vertebral column, and number of pleural ribs of *Acanthopsoides* species. Sample sizes are reported below each species' name; sample mean and standard deviation are reported with the minimum and maximum value observed reported below. Methods of counting are described in Materials and methods.

Species	*gracilis* n=25	*gracilentus* n=27	*hapalias* n=44	*delphax* n=36	*molobrion* n=16	*robertsi* n=47
Post-web.	36.9 .63	36.4 .79	35.5 .70	38.4 .77	36.4 .80	34.6 .65
vert.	35–38	35–38	34–37	37–40	35–38	33–36
Abdominal	17.8 .65	17.3 .62	16.7 .56	19.7 .58	17.2 .45	16.5 .75
vert.	16–20	16–19	16–18	19–21	17–18	15–18
Caudal	19.1 .73	19.0 .81	18.8 .82	18.8 .59	19.1 .96	18.1 .72
vert.	17–21	18–21	17–20	18–20	17–21	16–19
Peduncle	7.2 .69	7.3 .54	7.8 .51	7.6 .61	7.1 .57	8.3 .58
vert.	6– 9	6– 8	7– 9	7– 9	6– 8	7– 9
Dorsal-f.	13.8 .73	12.8 .48	13.2 .53	14.0 .56	12.9 .44	11.4 .53
pos.	12–16	12–14	12–14	13–15	12–14	10–12
Pelvic-f.	15.7 .49	15.4 .58	14.6 .58	16.8 .55	15.5 .52	13.8 .45
pos.	15–17	14–16	13–16	16–18	15–16	13–15
Anal-f.	24.9 .52	24.3 .66	23.5 .74	26.3 .85	24.6 .51	22.2 .61
pos.	24–27	23–26	22–26	25–28	24–25	21–23
Dor.-Pel.	1.8 .69	2.6 .56	1.4 .57	2.7 .66	2.5 .64	2.4 .62
differ.	0– 3	2– 4	0– 2	1– 4	2– 4	1– 4
Pleural	15.5 .59	15.4 .63	14.9 .55	17.8 .64	14.8 .83	13.5 .50
rib no.	14–17	14–17	14–16	17–19	13–16	13–14

only of species from single localities in the Chao Phraya River basin. Taki (1974) extended the range of the genus eastward from the Chao Phraya River basin into the Mekong River basin and Roberts (1989) extended it out onto the Sunda shelf with his report on the fishes of the Kapuas River basin, Kalimantan Barat. This study extends the known range over the whole of the island of Borneo, the whole of the Malay peninsula, and westward from Thailand into Burma. This discovery of a wider generic distribution has been due mainly to two factors: 1) modern collecting efforts have produced *Acanthopsoides* specimens in areas where previous collecting effects failed to produce them; and 2) the realization that some materials of *Acanthopsoides* collected in the 19th century and the first part of the 20th century were misidentified as *Acantopsis* species. That modern collecting efforts yield *Acanthopsoides* materials where previous efforts did not, might be due to the small size of *Acanthopsoides* species. Ichthyologists now know to look for miniature or small species and therefore are more likely to keep small fishes (Weitzman and Vari, 1989), and the use of ichthyocides is more effective than use of netting.

Consideration of the distribution of other loach genera in the region also indicates that the distribution of *Acanthopsoides* may be much wider than presently known, perhaps extending westward to the Irrawaddy River basin, Burma, into the lower Mekong River basin of Kampuchea and Vietnam and southward to Sumatra and Java. Croizat (1958, 1963) noted that distributions of taxa repeat, and taught that this repetition was the underpinning of a science of biogeography. That distributions repeat provides a basis for prediction. *Acantopsis*, the sister group to *Acanthopsoides*, and *Acanthophthalmus* are two other cobitid genera that have distributions circumscribed by the Irrawaddy River to the west and the Mekong River to the east on mainland Southeast Asia, by Borneo out on the Sunda shelf to the east, and by Sumatra and Java on the Sunda shelf to the south. *Acanthopsoides* may have a distribution similar to those of *Acantopsis* and *Acanthophthalmus*. Collections made in the region since 1950 indicate that *Acanthopsoides* is found wherever *Acantopsis* and *Acanthophthalmus* occur; additional collecting

Table 3. Morphometric information for *Acanthopsoides* species. Sample sizes are reported below each species' name; sample mean and standard deviation are reported with the minimum and maximum value observed reported below. The holotype was not always included in the sample measured. Methods of measurement are reported in Materials and methods. HL, PDL, and PPL are reported as per cent SL; SNT-OCC, SNT, EYE, and POL are reported as per cent HL.

Species	*gracilis* n=11	*gracilentus* n=11	*hapalias* n=10	*delphax* n=16	*molobrion* n=15	*robertsi* n=10
HL	20.5 .007	20.2 .009	21.6 .009	21.9 .028	22.1 .010	20.5 .007
	19.4–21.5	18.6–21.4	20.5–23.1	19.4–20.4	19.8–23.6	19.3–22.0
PDL	54.9 .019	54.1 .014	56.7 .011	54.9 .014	54.2 .012	52.6 .019
	52.4–59.0	52.2–56.6	54.9–59.2	52.6–57.7	51.7–56.6	49.5–55.6
PPL	55.5 .016	55.6 .011	57.6 .014	55.7 .011	55.6 .022	53.5 .010
	53.6–58.4	53.6–57.1	55.8–59.8	53.2–57.7	51.8–58.3	51.8–54.8
SNT-OCC	84.2 .040	84.2 .037	82.3 .080	87.2 .024	84.0 .034	85.3 .017
	77.0–92.6	75.6–88.2	61.7–89.7	81.0–90.4	78.5–89.1	82.3–87.5
SNT	40.3 .022	42.5 .025	39.1 .045	50.8 .015	42.3 .015	38.9 .021
	36.5–42.6	37.8–47.0	35.8–51.4	48.5–53.6	38.6–46.7	35.5–41.9
EYE	16.6 .010	15.1 .011	17.8 .009	15.6 .010	15.8 .007	16.6 .010
	15.2–17.7	13.9–17.6	16.1–19.1	13.9–18.3	14.3–16.9	15.2–18.9
POL	27.2 .019	28.0 .017	28.7 .018	18.1 .014	25.2 .012	30.7 .020
	25.0–30.9	24.7–30.5	26.3–31.7	15.1–20.6	24.0–28.6	27.9–34.1
POL/EYE	1.6 .134	1.9 .154	1.6 .144	1.2 .103	1.6 .108	1.8 .143
	1.4– 1.8	1.6– 2.1	1.4– 1.8	1.0– 1.3	1.4– 1.8	1.7– 2.1
SNT/EYE	2.4 .165	2.8 .212	2.2 .320	3.3 .259	2.7 .218	2.3 .210
	2.2– 2.7	2.4– 3.1	1.9– 3.0	2.7– 3.7	2.4– 3.1	2.0– 2.6
HL/EYE	6.0 .351	6.7 .447	5.6 .300	6.4 .396	6.3 .266	6.0 .347
	5.6– 6.6	5.7– 7.2	5.2– 6.2	5.5– 7.2	5.9– 7.0	5.3– 6.6
HL/SNT	2.5 .138	2.4 .142	2.6 .245	1.9 .076	2.4 .138	2.6 .138
	2.3– 2.7	2.1– 2.6	1.9– 2.8	1.9– 2.1	2.1– 2.6	2.4– 2.8

in the parts of the ranges of *Acantopsis* and *Acanthophthalmus* from which *Acanthopsoides* is not presently known and from which modern collections have not been made, will or will not, bear out the prediction.

Biodiversity. Kottelat's (1989: 1) recent compilation of the fishes known from the inland waters of Southeast Asia listed 930 species. The results of this study, and others, indicate that this figure of the known inland fish inhabitants of the area is a conservative estimate of the number of species that inhabit the area. This study of *Acanthopsoides* increases the number of species in the genus three-fold, and a similar increase in the number of *Acantopsis* species is indicated by preliminary data from a revision of this latter genus now in progress. This remark is not meant to imply that current estimates of the diversity of all Southeast Asian genera of freshwater fishes are underestimates by a factor of 3. However, it is meant to suggest the estimate of the number of freshwater fishes inhabiting Southeast Asia is low, potentially very low. A more general estimate of the likely extent of the underestimation of the size of the fauna can developed from Roberts' (1989) recent publication on the fauna of the Kapuas River, Kalimantan Barat. His work increased the known fauna of this river system by about half with much of the increase occrruing from newly discovered species in a wide array of the genera, and Roberts concluded diversity in the basin was still underestimated. There isn't any reason to believe that the Kapuas River fauna was especially unknown and that comparable studies, just as thorough, of other Southeast Asian areas won't turn up similar increases in diversity over most of the region.

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ドジョウ科 *Acanthopsoides* Fowler, 1934 の再検討と 4 新種の記載

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ドジョウ科の 1 属 *Acanthopsoides* Fowler, 1934 の再検討を行った．*Neacanthopsis* Smith, 1945 は，*Acanthopsis* 属のシノニムとした．*Acanthopsoides* の 2 種 (*A. gracilis* と *A. gracilentus*) にくわえて 4 新種 (*A. delphax, A. hapalias, A. molobrion, A. robertsi*) の記載を行い，同属魚類の分布域について検討した．同属魚類は東南アジアに広く分布するが，*A. glacilis, A. glacilentus, A. delphax, A. hapalias* は同所的に分布し，またカプアス河の *A. molobrion* と *A. robertsi*，メコン河の *A. glacilentus, A. delphax, A. hapalias* も同所的であると判断された．本研究で明らかにされた *Acanthopsoides* 属魚類の多様性は以下のことを示していると考えられる．すなわち，東南アジアの淡水魚類相は現在知られている以上のレベルの多様性を有している可能性がある．